CLAIMS

What is claimed is:

1.   A method of remote vocoder control within a wireless communication network, the method comprising:

5   determining rate-constraint and corresponding frame count values sufficient to

send desired signaling information from a radio access network (RAN) to

a mobile station in a number of rate-constrained voice frames using dim-

and-burst signaling; and

generating a control message comprising the rate-constraint and frame count

10   values for a remote media gateway providing voice frames to the RAN for

transmission to the mobile station, the media gateway performing

vocoding functions responsive to control messages received from the

RAN.

15   2.   The method of claim 1 further comprising:

sending the control message to the media gateway;

receiving one or more rate-constrained voice frames from the media gateway at

the RAN responsive to sending the control message; and

transmitting the signaling information to the mobile station by inserting the

20   signaling information into the rate-constrained voice frames using dim-

and-burst signaling.

3.   The method of claim 2 further comprising transmitting any remaining portion of

the signaling information to the mobile station using blank-and-burst signaling if a

25   sufficient number of rate-constrained voice frames are not received within a defined time

period of sending the control message to the media gateway.

4.   The method of claim 3 further comprising:

starting a timer in association with sending the control message; and

determining the end of the defined time period as an expiration of the timer.

5   5.   The method of claim 4 further comprising configuring an expiration period of the

timer based on the signaling information to be sent to the mobile station.

6.   The method of claim 4 further comprising:

incrementing a counter each time at least a portion of the signaling information is

10   sent via one of the rate-constrained voice frames received at the RAN

from the media gateway responsive to the control message; and

stopping the timer if the counter reaches the frame count value sent in the control

message.

15   7.   The method of claim 4 further comprising:

tracking transmission of the signaling information; and

stopping the timer if all of the signaling information is sent before expiration of the

timer.

20   8.   The method of claim 1 further comprising configuring the control message as

binary fields within a voice frame passing from the RAN to the media gateway.

9.   The method of claim 8 further comprising:

defining a first one of the binary fields as the rate-constraint value specifying a

25   binary-encoded rate constraint; and

defining a second one of the binary fields as the frame count value specifying a

binary-encoded frame count;

wherein the rate constraint indicates a constraint relative to a full-rate setting in

use by the media gateway for the mobile station, and wherein the frame

5   count specifies the number of rate-constrained voice frames required to

send all of the signaling information.

10.   The method of claim 9 further comprising defining a third one of the binary fields

as an indicator field that alerts the media gateway to the presence of the first and second

10   fields.

11.   The method of claim 1 further comprising controlling vocoding functions at the

media gateway for a plurality of mobile stations supported by the RAN.

15   12.   The method of claim 1 further comprising controlling vocoding functions at the

media gateway from a base station controller (BSC) comprising a portion of the RAN.

13.   A method of performing vocoding at a media gateway operating within a wireless

communication network, the method comprising:

receiving voice data for a mobile station from the Public Switched Telephone

Network (PSTN);

5   encoding the voice data into voice frames at a desired encoding rate for transfer

to a radio access network (RAN) supporting the mobile station;

receiving a control message from the RAN comprising a rate constraint value and

a frame count value;

constraining the encoding rate for a number of subsequent voice frames sent

10   from the media gateway to the RAN for the mobile station responsive to

the control message, wherein the number of rate-constrained voice

frames sent is limited by the frame count in the control message; and

returning to the desired encoding rate after sending the rate-constrained voice

frames.

15

14.   The method of claim 13 further comprising:

receiving a plurality of control messages;

buffering the control messages; and

responding to buffered control message based on a defined priority.

20

15.   The method of claim 14 further comprising setting the defined priority as a first-in-

first-out priority such that buffered control messages are processed in the order

received.

16.   The method of claim 13 further comprising controlling the encoding rate for a plurality of mobile stations responsive to corresponding control messages sent by the RAN.

5   17.   The method of claim 13 further comprising receiving the control message from a base station controller (BSC) supporting radio communication with the mobile station.

18.   The method of claim 13 further comprising receiving voice frames from the RAN through a packet core network, and wherein voice frames are carried as packet data

10   through the packet core network.

19.   The method of claim 18 further comprising receiving the control message within a voice frame received from the RAN.

15   20.   The method of claim 13 further comprising receiving the voice data from the PSTN as 64 kbit pulse-code-modulated (PCM) data.

21.   The method of claim 13 wherein the desired encoding rate is considered full-rate encoding for a call the mobile station is engaged in, and wherein constraining the

20   encoding rate of voice frames responsive to the control message comprises reducing the encoding rate to at least the rate constraint value specified by the control message.

22.   The method of claim 21 further comprising rate constraining fewer frames than specified by the frame count value in the control message if encoding is constrained to a

25   lower encoding rate than that specified by the rate constraint value in the control message.

23.   The method of claim 22 wherein a lower encoding rate corresponds to a lower bit
rate for the encoded voice data.

24.   A method of controlling vocoding within a wireless communication network, the
5   method comprising:

receiving voice data for a mobile station at a media gateway;

encoding the voice data into voice frames at a desired encoding rate;

transferring the voice frames to a radio access network (RAN) supporting radio

communication with the mobile station;

10   determining rate constraint and frame count values required to transmit desired

signaling information using dim-and-burst signaling within voice frames

transmitted to the mobile station by the RAN;

sending a control message comprising the rate constraint and frame count

values from the RAN to the media gateway;

15   constraining the encoding rate for a defined number of subsequent voice frames

sent from the media gateway to the RAN for the mobile station responsive

to the control message;

sending the desired signaling information to the mobile station from the RAN

using dim-and-burst signaling within the rate-constrained voice frames

20   received from the media gateway responsive to the control

message; and

returning to a desired encoding rate at the media gateway after sending the

defined number of rate-constrained frames.

25

22

25.   The method of claim 24 further comprising sending any remaining portion of the

desired signaling information from the RAN to the mobile station using blank-and-burst

signaling if a sufficient number of rate-constrained voice frames are not received from

the media gateway at the RAN within a defined time period of sending the control

5   message.

26.   The method of claim 25 further comprising determining the defined time period

based on a timer having a defined expiration period.

10   27.   The method of claim 26 further comprising configuring the defined expiration

period of the timer based on timing requirements associated with the desired signaling

information, such that the desired signaling information is sent within time limits imposed

by the air interface adopted by the network for radio communications between mobile

stations and the RAN.

15

28.   The method of claim 25 further comprising:

incrementing a counter for each rate-constrained frame received at the RAN

within the expiration period of the timer; and

stopping the timer if the counter reaches the frame count value before expiration

20   of the timer.

29.   The method of claim 25 further comprising:

tracking transmission of the desired signaling information to the mobile station

from the RAN; and

25   stopping the timer if all of the desired signaling information is sent before

expiration of the timer.

30.   The method of claim 24 further comprising configuring the control message as

binary fields within a voice frame passing from the RAN to the media gateway.

31.   The method of claim 30 further comprising:

5   defining a first one of the binary fields as the rate-constraint value specifying a

                binary-encoded rate constraint; and

          defining a second one of the binary fields as the frame count value specifying a

                binary-encoded frame count;

          wherein the rate constraint indicates a constraint relative to a full-rate setting in

10   use by the media gateway for the mobile station, and wherein the frame

                count specifies the number of rate-constrained voice frames required to

                send all of the signaling information.

32.   The method of claim 31 further comprising defining a third one of the binary fields

15   as an indicator field that alerts the media gateway to the presence of the first and second

fields.

33.   The method of claim 24 further comprising controlling vocoding functions at the

media gateway for a plurality of mobile stations supported by the RAN.

20

34.   The method of claim 24 further comprising controlling vocoding functions at the

media gateway from a base station controller (BSC) comprising a portion of the RAN.

35.   A base station controller (BSC) for use in a wireless communication network, the

BSC comprising at least one processor operative to:

    determine rate-constraint and corresponding frame count values sufficient to

        support sending desired signaling information from a radio access

5   network (RAN) to a mobile station in a number of rate-constrained voice

        frames using dim-and-burst signaling; and

    generate a control message comprising the rate-constraint and frame count

        values for a remote media gateway providing voice frames to the RAN for

        transmission to the mobile station, the media gateway performing

10   vocoding functions responsive to control messages received

        from the RAN.

36.   The BSC of claim 35 further wherein the at least one processor:

    sends the control message to the media gateway;

15   receives one or more rate-constrained voice frames from the media gateway at

        the RAN responsive to the control message; and

    transmits the signaling information to the mobile station by inserting the

        signaling information into the rate-constrained voice frames using dim-

        and-burst signaling.

20

37.   The BSC of claim 36 wherein the at least one processor transmits any remaining

portion of the signaling information to the mobile station using blank-and-burst signaling

if a sufficient number of rate-constrained voice frames are not received within a defined

time period of sending the control message to the media gateway.

25

38.   The BSC of claim 37 wherein the at least one processor:

starts a timer in association with sending the control message; and

determines the end of the defined time period as an expiration of the timer.

5   39.   The BSC of claim 38 wherein the at least one processor configures an expiration

period of the timer based on the signaling information to be sent to the mobile station.

40.   The BSC of claim 38 wherein the at least one processor:

increments a counter each time at least a portion of the signaling information is

10   sent via one of the rate-constrained voice frames received at the RAN

from the media gateway responsive to the control message; and

stops the timer if the counter reaches the frame count value sent in the control

message.

15   41.   The BSC of claim 38 wherein the at least one processor:

tracks transmission of the signaling information; and

stops the timer if all of the signaling information is sent before expiration of

the timer.

20   42.   The BSC of claim 35 wherein the at least one processor configures the control

message as binary fields within a voice frame passing from the RAN to the media

gateway.

25

43.   The BSC of claim 42 wherein the at least one processor:

defines a first one of the binary fields as the rate-constraint value specifying a

binary-encoded rate constraint; and

defines a second one of the binary fields as the frame count value specifying a

5   binary-encoded frame count; and

wherein the rate constraint indicates a constraint relative to a full-rate setting in

use by the media gateway for the mobile station, and wherein the frame

count specifies the number of rate-constrained voice frames required to

send all of the signaling information.

10

44.   The BSC of claim 43 wherein the at least one processor defines a third one of

the binary fields as an indicator field that alerts the media gateway to the presence of the

first and second fields.

15   45.   The BSC of claim 35 wherein the at least one processor controls vocoding

functions at the media gateway for a plurality of mobile stations supported by the RAN.

46.   The BSC of claim 35 wherein the at least one processor comprises a plurality of

processing systems within the BSC.

20

47.   A media gateway for use in a wireless communication network, the media

gateway comprising at least one processor operative to:

    receive voice data for a mobile station from the Public Switched Telephone

        Network (PSTN);

5   encode the voice data into voice frames at a desired encoding rate for transfer to

        a radio access network (RAN) supporting the mobile station;

    receive a voice frame associated with the mobile station from the RAN containing

        a control message comprising both a rate constraint value and a frame

        count value;

10   constrain the encoding rate for a number of subsequent voice frames sent from

        the media gateway to the RAN for the mobile station responsive to the

        control message, wherein the number of rate-constrained voice frames

        sent is limited by the frame count in the control message; and

    return to the desired encoding rate after sending the rate-constrained voice

15   frames.

48.   The media gateway of claim 47 wherein the at least one processor:

    receives a plurality of control messages;

    buffers the control messages; and

20   responds to each control message in the order the control messages were

        received at the media gateway.

49.   The media gateway of claim 47 wherein the at least one processor controls the

encoding rate for a plurality of mobile stations responsive to corresponding control

25   messages sent by the RAN.

50.   The media gateway of claim 47 wherein the at least one processor receives the control message from a base station controller (BSC) supporting radio communication with the mobile station.

5   51.   The media gateway of claim 47 wherein the at least one processor receives voice frames from the RAN through a packet core network, and wherein voice frames are carried as packet data through the packet core network.

52.   The media gateway of claim 47 wherein the at least one processor receives the

10   voice data from the PSTN as 64 kbit pulse-code-modulated (PCM) data.

53.   The media gateway of claim 47 wherein the desired encoding rate is considered full-rate encoding for a call the mobile station is engaged in, and wherein the at least one processor constrains the encoding rate of voice frames responsive to the control

15   message by reducing the encoding rate to at least the rate constraint value specified by the control message.

54.   The media gateway of claim 53 wherein the at least one processor rate-constrains fewer frames than specified by the frame count value in the control message

20   if encoding is constrained to a lower encoding rate than that specified by the rate constraint value in the control message.

55.   The media gateway of claim 54 wherein a lower encoding rate corresponds to a lower bit rate for the encoded voice data.

25

56.   The media gateway of claim 47 wherein the at least one processor comprises a

plurality of processing systems within the media gateway.

57.   The media gateway of claim 47 further comprising memory operative to buffer

5   control messages received from the RAN at the media gateway.

58.   A wireless communication network comprising:

a base station controller (BSC) comprising at least one processor adapted to

control remote vocoding operations such that voice frames sent to the

10   BSC for transmission to a mobile station may be temporarily rate-

constrained in support of the BSC sending signaling messages to the

mobile station using dim-and-burst signaling; and

a media gateway comprising at least one processor adapted to rate-constrain

voice frames sent from the media gateway to the BSC for the mobile

15   station responsive to control messages from the BSC, and wherein the

BSC generates control messages such that each control message

defines a desired rate-constraint value and a corresponding frame count

value specifying the number of frames to which the rate-constraint value

should be applied.

20

59.   The network of claim 58 wherein the media gateway, for a given control

message, limits the number of voice frames to which the rate-constraint is applied based

on the frame count value in the control message.

60.   The network of claim 59 wherein the media gateway returns to a desired encoding rate after rate-constraining a defined number of voice frames responsive to a control message.

5   61.   The network of claim 58 wherein the BSC and the media gateway cooperate to provide vocoding control for a plurality of mobile stations.

62.   The network of claim 61 wherein the BSC generates control messages specific to each of the plurality of mobile stations, and wherein the media gateway applies rate-

10   constraints associated with a given control message to the voice frames associated with the corresponding mobile station.

63.   The network of claim 58 wherein the BSC sends signaling information to the mobile station using blank-and-burst signaling techniques for any remaining portion of a

15   given signaling message if a sufficient number of rate-constrained voice frames for the mobile station are not received within a defined time period after sending the control message.

20